They are supposed by the official geologists of the U.S. Survey and others to include large masses of altered Palæozoic sediments, while the author supports the alternative opinion that most of these rocks are Pre-Cambrian. The Triassic rocks of the western side of the Hudson River, with their intrusive diabase which forms the picturesque Palisades, and the sparingly exposed Cretaceous strata of Staten Island are the only other "solid" formations known in the neighbourhood of New York.

The drift deposits and their associated phenomena, everywhere conspicuous, afford the subject for the final chapter of the book, which the author presents in a strain calculated to impress the uninitiated.

The arrangement of the book is somewhat confusing to the outsider, being based on the municipal divisions of the city. The style of writing is often turgid, over-ornamented, and not particularly accurate. A region is described as of "pene-Saharal loneliness"; there have been "loculicidal slippings" in the gneiss (the botanical adjective looking quite aggressive here); the drifts "tell the singular story which the long, tireless and infinite retinue of glacialists has been engaged in translating these long years"; and so on. Misprints are numerous, even in the preface "carefully" appearing as "carfully"; the so-called "bibliographies" contain few proper references; and there is no index to the volume.

In some appended notes on the archæology of Manhattan Island, some relics of the British army engaged in the Revolution are mentioned; and, considering the recency of the period, it seems curious to read that "the habits and life of the soldiery have been traced by the remains of their food, utensils, pikes, cutlery." G. W. L.

THE LAWS OF INHERITANCE.

Elemente der exakten Erblichkeitslehre. Deutsche wesentlich Erweiterte Ausgabe in Fünfundzwanzig Vorlesungen. By W. Johannsen. Pp. vi+516. (Jena: Gustav Fischer, 1909.) Price 9 marks.

WITHIN the last few years the output of exact experimental work upon phenomena of heredity has been very large, and the progress made, as compared with that of the previous forty years, has been astounding. In England it has chiefly been produced by investigators who have strictly segregated themselves either to the Mendelian or the biometrical schools, and who as a rule seem unable to realise the merits of the work of their rivals. One may pause in astonishment on reading, in a recent work issued by the head of the Mendelian school, that

> "Of the so-called investigations of heredity pursued by extensions of Galton's non-analytical method and promoted by Prof. Pearson and the English biometrical school it is now scarcely necessary to speak. That such work may ultimately contribute to the development of statistical theory cannot be denied, but as applied to the problems of heredity the effort has resulted only in the concealment of that order which it was ostensibly undertaken to reveal. . . . With the discovery of segregation, it became obvious that methods dispensing with individual analysis of the material are useless."

Most biologists, with no axes to grind, are able to appreciate the importance of the work of both schools, though at present it is scarcely possible for them to judge whether the work of the one is destined to be of more permanent value than that of the other. The mutually destructive criticism of the two, though not without value in stimulating healthy competition, has the unfortunate result that the biologist who is wedded to neither school finds it difficult to lay his hands upon an adequate but impartial description of their methods and results. To such we can cordially recommend the work on inheritance, by Prof. Johannsen, now before us. The Danish edition of this book was published in 1905, but the present edition is double the size of the original, and is practically a new work. It consists of twenty-five lectures, in the first eight of which the facts of variation and its statistical study are discussed. The author then describes at some length his own very interesting experiments upon a "pure line" of self-fertilised beans (Phaseolus), which he bred for six generations. He found that selection within such a pure line did not lead to departure from the type, *i.e.* beans grown from a small bean were exactly the same size as those grown from a large bean of the same plant. He designates these non-heritable variations in size as "fluctuations." These results have coloured the author's outlook upon problems of segregation, mutation, and selection, and before accepting his interpretation the criticism of his experimental results by Prof. Pearson and the late Prof. Weldon should be studied ("Biometrika," ii., p. 499).

In subsequent lectures the author discusses discontinuous variation, correlation, regression, and the effects of conditions of life, and then passes on to describe Mendel's law and de Vries's theory of mutation. Darwin's principle of natural selection acting continuously upon small, indefinite variations finds but small favour in his eyes, and he attributes the origin of species to the appearance of mutations and the production of new races by crossing, the new characters being propagated unchanged in accordance with Mendel's law. Selection produces nothing, but extirpates unfavourable mutations, and so leaves room for new and favourable ones. However, the author makes no attempt to explain how mutations, in spite of their extreme rarity, have been able to effect so much. Hence, as is only to be expected, these views on heredity, though worthy of full consideration, must be studied in a critical spirit. H. M. VERNON.

OUR BOOK SHELF.

A Sketch of the Geography and Geology of the Himalaya Mountains and Tibet. By Col. S. G. Burrard, R.E., F.R.S., and H. H. Hayden. Part iv. The Geology of the Himalaya. (Calcutta: Government Printing Office, 1908.) Price 2 rupees.

THE fourth part of the sketch of the geography and geology of the Himalayas is entirely the work of Mr. H. H. Hayden, and is devoted to a review of the present state of our knowledge of the Himalayas. This knowledge is fragmentary; of the Himalayas east of Sikkim only a few small patches, and these close to the southern margin, have been visited, then

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comes the independent State of Nepal, of which nothing at all is known, and it is only in the British territory and the native States under British control at the north-western extremity of the range that the geology is known, even approximately There is, consequently, a tendency to extend the knowledge of this region to the rest of the range, and to draw conclusions which are only doubtfully applicable.

This tendency has not altogether been avoided, and the lengthy discussion of the age of the unfossiliferous sedimentary rocks of the Simla region seems to give this subject an importance which it does not possess, especially as, in the end, it is left in a state of little less uncertainty than before. The only clue to the age of these rocks is the fact that they contain a series of beds, the Blaini, which is generally acknowledged to present unmistakable signs of glacial origin. At one time this series was regarded as of Permian age, but this explanation is rejected, and the Blaini series is correlated with the pre-Cambrian glaciation which has been studied and described in Africa, China, Australia, and, we may add, in Norway. Mr. Hayden argues with great plausibility that the complete absence of any trace of fossils in a great thickness of rocks, which might well be expected to contain them, and their abundance in the great series of deposits on the other side of the snowy range, is more reasonably explained by a difference in age than in conditions of deposition. This reasoning we may accept, and acknowledge that the Blaini tillites are more probably pre-Cambrian than Permian in age, but the possibility that the rocks of the Simla area are a flysch facies of the fossiliferous sediments of Spiti must be borne in mind, and, until less equivocal evidence is adduced, the problem must remain unsolved.

With this exception the work is a well-balanced summary of the geology of the Himalayas, useful to those who wish to have the leading facts put briefly and clearly, and also, by the copious references to original authorities, invaluable as a guide to more detailed study.

Elementary Physiology for Teachers and Others. By W. B. Drummond. Pp. viii+198; illustrated. (London: Edward Arnold, 1909.) Price 2*s.* 6*d.*

THIS is a useful little book of its kind, elementary, as its title implies, and correct in its details, an element so often lacking in similar works. Like other books of its class, it necessarily contains a good deal of what is anatomy rather than physiology, and it chiefly differs from its competitors in pointing out the applications of physiology in the health, well-being, and training of children. This is by no means an unimportant point, seeing that the work is written for school teachers. W. D. H.

Evolution: A General Sketch from Nebula to Man. By Joseph McCabe. Pp. vii+128. (London: Milner and Company, Ltd., n.d.) Price 1*s.* net.

THE author of this little book defines his aim as being "chiefly to present a panoramic view of the development of the world—especially the world that lies close about us—by a conscientious use of the results of many sciences, and aided by a personal acquaintance during many years with both telescope and microscope." The style is interesting, and the slight sketch provided may send a few general readers to first-hand authorities for further information. The language is not always precise; for instance, we find "refractory liquid fire," "a lowering of climate," and so on; but on the whole the volume may serve a useful purpose by introducing non-scientific readers to some problems of inorganic and organic evolution.

LETTERS TO THE EDITOR.

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Magnetic Storms and Solar Eruptions.

REFERRING back to the *Electrician* of nine years ago (December 7, 1900), I find that, following up a suggestion of G. F. FitzGerald made in 1893, I promulgated a view of major magnetic storms which events have confirmed. See, for instance, Mr. Maunder's paper in Mon. Not. R.A.S. for 1904, vol. lxv., p. 33.

What I have to point out is that a stream or beam of electrons ejected from the sun and passing near or over the earth would cause magnetic perturbations of the kind required—positive as it approached, zero as it passed over, negative as it receded; with many minor disturbances superposed due to variations of density, as well as others due to the effect of particles caught by the atmosphere.

Such a beam or stream of electrified particles is essentially a magnetic cyclone, and the changes in magnetic force as it travels past any locality bear a fairly close analogy with the changes in wind-velocity during the passage of an atmospheric cyclone.

The relative speed of such a solar beam, as it overtakes the earth, follows from the sun's angular velocity, and is 210 miles a second.

Earth currents would, in the main, be induced as it approached and checked as it receded.

The rotation of the earth in the magnetic field of such a stream is too slow to be effective: though locally in the neighbourhood of six o'clock an intense ray of the main beam might generate east and west currents.

Now magnetic disturbances recorded during the recent storm, and quoted by Dr. Chree in the *Times* and elsewhere, indicate a declination deflection of $1\frac{1}{2}$ degrees, followed by a reversed deflection of the same amount—all within a quarter of an hour.

This means—on the above theory—that the main beam took this time to traverse the place, so that the breadth of the beam was comparable to twenty times the earth's diameter. No doubt it is diffused, at this distance from the sun, by internal repulsion of the particles.

The intensity of field which would give the above deflection is approximately one-fortieth of that of the earth's horizontal intensity, or, say, 0·004 C.G.S., as the order of magnitude.

Taking these data, together with the known charge and velocity of electrons in kathode rays—say $e=10^{-20}$ electromagnetic C.G.S. units, $u=10^9$ centimetres per second—let us reckon the closeness of the crowd of particles in the beam necessary to account for the observed force.

The magnetic intensity at any place, distant r from the axis of a linear stream of sectional radius a and current density γ, is given by the following expressions:—

$$H=\frac{2C}{r}$$

$$C=\pi a^2\gamma$$

$$\gamma=n_1 eu,$$

where n_1 is the number of particles per cubic centimetre of the stream.

This gives

$$n_1=\frac{rH}{2\pi a^2 eu},$$

so taking a place just grazed by the beam, so that $r=a=20\times 2/\pi\times 10^9$, and putting in the other data just cited, we get

$$n_1=\frac{0{\cdot}004}{80\times 10^9\times 10^{-11}}$$

$$=0{\cdot}005 \text{ per c.c.},$$

or, say, five electrons per litre, on the average, all through the beam. I regard this as a modest and not unlikely estimate of crowdedness. The amount of matter ejected from the sun in this beam is insignificant, being less than a couple of tons per week.

The total current equivalent of such a beam is six

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